In the United States Patent and Trademark Office

Serial No. _____

Appn. Filed : _____

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6/IDS
E. Willis
8-19-02

Appn. Title: MASS SPECTROMETER BASED ON THE USE OF QUADRUPOLE LENSES WITH ANGULAR GRADIENT OF THE ELECTROSTATIC FIELD

Examiner/GAU: _____

Mailed: Jan 7, 02

At: SFO

Information Disclosure Statement

Assistant Commissioner for Patents
Washington, District of Columbia 20231

Sir:

Attached is a completed Form PTO-1449 and copies of the pertinent parts of the references cited thereon. Following are comments on references pursuant to Rule 98:

More detail general information about types and constructions of ion sources suitable for use in mass spectrometers can be found in "Industrial Plasma Engineering" by Reece Roth, Vol. 1, Institute of Physics Publishing, Bristol and Philadelphia, 1992, pp. 206-218.

US Patent No. 5,396,065 issued in 1995 to C. Myerholtz, et al. discloses an encoded sequence of ions in packets for use in time-of-flight mass spectrometers, in which the high-mass ions of a leading packet will be passed by the low-mass ions of a trailing packet. However, such method and apparatus

makes interpretation of obtained data more complicated and not easily comprehensible. Furthermore, addition electronic circuits are required for control of the ion packet sequence.

US Patent No. 5,753,909 issued in 1998 to M. Park et al. describes a method and apparatus for analyzing ions by determining times of flight including using a collision cell to activate ions toward fragmentation and a deflector to direct ions away from their otherwise intended or parallel course. A disadvantage of this device consists in that it is based on the selection of specific ions and does not show the entire mass spectrum. For obtaining the entire spectrum, it is necessary to perform step by step scanning, and this requires an additional time.

US Patent No. 6107,625 issued in 2000 to M. Park discloses a coaxial multiple reflection time-of-flight mass spectrometer of a time-of-flight type with resolution capacity improved due to a longer time of flight of the ions. During the mass analysis, the ions are reflected back and forth between the accelerator and reflectron multiple times. This is a typical system with storage of ions which does not allow a continuous mode of mass analysis since it requires period de-energization of one of the reflecting device. Obviously, the data is difficult to interpret, especially when masses of ions are scattered in a wide range so that light ions may undergo several reflection while heavy ions made only one or two reflections.

Thus, none of the references mentioned above discloses, as claimed in my main Claim 1 with dependent Claims 2-30, a mass spectrometer based on the use of quadrupole lenses with angular gradient of the electrostatic field for moving ions along helical trajectories in a direct and return stroke with return of the ions along helical trajectories different from those of the direct strokes due to the use of a magnetic and/or electrostatic mirrors. Furthermore, none of the aforementioned references discloses, as claimed in my independent Claim 31 with dependent Claim 32 and in independent Claim 32, a method of spectrometric mass analysis comprising the steps of injecting packets of irons into an ion mass separation

chamber non-coaxially with the chamber, generating electrostatic magnetic field in the chamber to force the ions to move along helical trajectories in a direct and return strokes, and to detect the points of collision of ions with the ion-electron emitting screen.

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